

Project Title: Carbon Flux and Storage in Mixed Oak Forests of MOFEP

MDC Project Leader: Randy Jensen

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Project Summary

This study, identified as a research priority of MOFEP, addresses C sequestration and the compounding impacts of global change, N deposition, and alternative management protocols that are important themes in contemporary research in forestry and ecology, as well as development of optimal management plans for the future of Ozark forests. Our overall objective in previous projects was to quantify differences in carbon flux and storage within mixed oak forests of the Southeastern Missouri Ozarks resulting from alternative management practices, landscape form, and climate change. The experimental units of the MOFEP provided the basis of a model predicting net ecosystem exchanges of carbon [NEC, i.e., net ecosystem productivity (NEP)] at multiple temporal scales and within a spatial context of NEC and C storage using process-based ecosystem model (PnET) and Landsat imagery, along with ecological land type phases (ELTP) coverages and digital elevation model (DEM) databases.

This project seeks to address questions of carbon flux and sequestration, as well as the compounding impacts of global change and nitrogen deposition, that are important themes in contemporary research programs such as DOE, NSF NASA, JFSP, and USDA. Specific objectives are:

1. To continue field measurements of various carbon (C) fluxes/stocks and associated soil and vegetation measurements (e.g., microclimate) to understand the intra-annual variability (i.e., climate controls) following the alternative treatments;
2. To evaluate detailed biogeochemical regulations of the C cycle, including water use, light use, nutrient use efficiencies; and
3. To model and predict the changes in C credits of different silvicultural options and of the landscape (i.e., remote sensing and ecosystem modeling).

Major Products from 7/1/2007 – 6/30/2008

1. *Field Data collections* (all data have been uploaded to MDC server)

- We used data collected through the MOFEP's Forest Vegetation project to estimate aboveground biomass increment (i.e., annual C flux) and leaf area
- We did monthly respiration measurements at 18 selected plots from the previous project using a portable IRGA (PP Systems), along with temperature, leaf depth (cm), and moisture (TDR) measurement. Respiration is measured at the soil surface, live and dead trees, and coarse woody debris (CWD). These data will be used to examine the intra-annual variability and biophysical regulations of soil carbon flux. (*for C flux*)
- We did monthly maintenance and data acquisition from 18 HOBO dataloggers. (*for mechanisms*)
- We did monthly respiration measurements at the 9 selected plots from a previous project using a portable IRGA (PP Systems), along with temperature and moisture (TDR) measurements. Also,

maintenance and data acquisition from the 12 HOBO dataloggers (9 at the soil pits and 3 in adjacent pits with wires buried (site 1 plot 20, site 3 plot 67, and site 4 plot 70).

- We organized the database of overstory, litter-fall, CWD, soil total carbon, and ground litter for quantifying carbon pools. (*for C storage*)
- We will conduct mass loss and chemistry analysis of litterbags from the last scheduled collection in summer 2007-2009. (*for C flux*)

2. Proposal development to enhance MOFEP Carbon Study

One of the research components of this study is to develop external proposals to enhance the magnitude of carbon study. Four proposals were submitted during this period. They are:

- **Chen, J.** Kim Brosofske. New Concept of Resource Use Efficiencies as the Mechanistic Foundation for Ecosystem Production: Tests through Manipulating Ozark Forests. 4 years, \$780,235, NSF, Submitted on Jan. 9, 2008. (pending)
- **Chen, J.** and S. McNulty. Maintaining Optimum Carbon Sequestration through Forest Management in a Changing Climate: Synthetic Lessons from the Large Forest Manipulation Experiments. The Climate Change Program of USDA FS. \$300,000 (2 years), Pre-proposal submitted on Feb. 25, 2008 (pending)
- **Chen, J.** Integrating Multi-Resource use into a Cohesive Model: tests and applications. DOE-IARP Program), \$315,000, 3 years. Pre-proposal submitted on 3/10/08 (declined)
- Moser, W., **J. Chen**, and M. Hanson. Managing Conflicting Forest Health Risk for Maximizing Carbon Sequestration in Forest Ecosystems. Preproposal submitted on April 20, 2007 (\$50,000 per year, 3 yrs) (pending)

3. Publications

- Henderson, R, Q. Li, J. Chen, C. Mayer, M. Weintraub, and R. Jensen. Manipulating Overstory Canopies Changed Vertical Soil CO₂ Efflux in MOFEP. *Forest Ecology and Management* (in internal review).
- Li, Q., D. L. Moorhead, J. L. DeForest, and J. Chen, R. Henderson, R. Jensen. Mixed litter decomposition in a managed Missouri Ozark forest ecosystem. *Soil Biology and Biogeochemistry*. (in revision)
- Li, L. J. Chen, J. L. DeForest, R. Jensen, D. L. Moorhead, and R. Henderson. 2007. Effects of timber harvest on carbon pools in Ozark forests. *Canadian Journal of Forest Research* 37: 2337-2348.
- Li, Q., J. Chen, M.K. Bresee, J.A. Rademacher, and J.J. LaCroix. 2007. Areas influenced by multiple edges and their implications in fragmented landscapes. *Forest Ecology and Management* 242: 99-107.
- Henderson, Rachel. 2007. Soil Effluxes of vertical profiles at MOFEP Experiments. M.S. Thesis, University of Toledo. The VDM Publisher of Germany will publish her thesis.
- Qinglin Li, 2006. Carbon storage and fluxes in a managed oak forest landscape. Ph.D. Thesis, University of Toledo

4. Data location

All data of our research in MOFEP have been uploaded to MOFEP website.
(<http://mofep.mdc.mo.gov>). The filenames and study in which each file is provided below:

Filenames	Study
2007WeatherStation.xls	Weather Station
2007SoilPits.xls	Vertical Soil Respiration
2007VegPlots.xls	Soil Respiration
2007transect.xls	Soil Respiration
2007HOBO.xls	Soil temperature

Appendix: Email request from VDM Verlag to publish R. Henderson's Thesis based at MOFEP

Date: Thu, 27 Mar 2008 11:22:45 +0100
From: Chiponda Chimbelu <c.chimbelu@vdm-publishing.com>
User-Agent: IceDove 1.5.0.10 (X11/20070329)
To: rachel.henderson@utoledo.edu
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X-Mlf-Threat: nothreat
X-Mlf-Threat-Detailed: nothreat;none;none;none
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X-OriginalArrivalTime: 27 Mar 2008 10:22:48.0528 (UTC) FILETIME=[815E1D00:01C88FF4]

Dear Rachel Henderson,

In the course of my research on ecology, I came across a link to your dissertations: 'Partitioning Soil CO2 Efflux Through Vertical Profiles of Manipulated Forests in MOFEP'. VDM Verlag would be especially interested in publishing your research on this subject.

A response including an e-mail address to which I can send further information in attachment would be greatly appreciated.

I look forward to hearing from you.

Kind Regards,

Chiponda Chimbelu (M.A., English)
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